Notes on Land Mollusca from Mount Kinabalu, British North Borneo

By F. F. LAIDLAW

PLATE XI

The following notes are based on material collected by Messrs. Pendlebury and Chasen in the course of their expedition to Mt. Kinabalu in 1929. I have been able to add some remarks on specimens collected by Dr. Hanitsch thirty years previously. The list given includes only species for which I have been able to find a record of altitude of 3,000 feet or upwards. Therefore it is not a full list of species recorded from the Kinabalu area.

I have to think the Director of the Raffles Museum for the opportunity of examining this interesting material, and to acknowledge my indebtedness to Col. Peile for notes and figures of the radulæ of some of them. I have also to thank the authorities of the British Museum for permission to have figures made of the type specimen of *Everettia aglaia* Pfr.

In the 'mountain zone' I include—

(1) Lower mountain zone 3,000–6,000 ft.

(2) Upper mountain zone 6,000–10,500 ft.

according to Stapf's suggestion. (Trans. Linn. Soc., ser. 2, IV, 1894, pp. 66–263, pls. 11–20).

The types of the new species will be deposited in the British Museum.

PHILOMYCIDÆ

Meghimatium uniforme sp.n. Fig. 1, 2.

Type.—A specimen from Pakka, Kinabalu, 10,000 feet, April, 1929, F. N. C. and H. M. P.

Material.—Twelve specimens from Pakka, including the type.

The specimens average about 20 mm. in length, and are of a uniform gray-brown colour, entirely without markings.

They differ from other species of the genus that I have seen in being more rounded in outline and with the extremities tapering less gradually.

The reproductive apparatus appears rather primitive as regards the structure of the terminal part of the male organs.

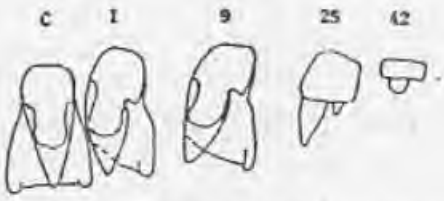

Fig. 1. *Meghimatium uniforme.* Teeth from radula, × 400.

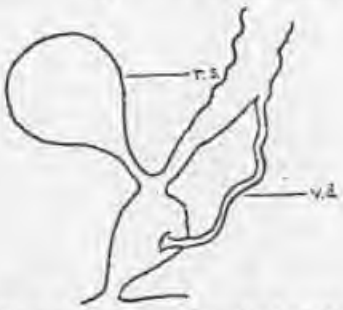

Fig. 2. *Meghimatium uniforme.* Terminal parts of genital apparatus. *r.s.*=receptaculum seminalis; *v.d.*=vas deferens.

The hermaphrodite gland lies rather behind the middle of the body on the right side, it is recognizable by the black pigment of the connective tissue in which the lobules of the gland are embedded. From it the convoluted hermaphrodite duct runs through the albumen gland, which is divided into a number of wedge-shaped lobes, to join the thick, much folded common duct.

Quite near the lower end of the latter the short vas deferens separates off, and without any widening or muscular attachment passes, after a course of about 3 or 4 mm. directly into the terminal sac, on the upper surface, and towards the median aspect of the latter.

The free oviduct is also a short tube, which passes into the terminal sac more to the right and at a lower level than in the case of the vas. As it enters the sac it receives the short duct of the spherical receptaculum seminis.

The terminal sac is a pyriform organ, its pointed, anterior end opening to the exterior by the common genital aperture. I have not been able to make out the structure of the interior of the sac.

The development of the heart and kidney is intermediate between the condition figured by Hoffmann for *pictum* and *striatum* (Hoffmann, 1924, Jena. Zeitschr. Naturwiss., 60)

1

2

Everettia spp.

The kidney extends on either side of the heart to a greater extent than in *striatum*, and overlaps it to some degree, but not so much as in *pictum*.

The radula has a length of about 4 mm. and a width of 1.3 mm. Number of rows of teeth 145 + nascent. Formula 44–1–44. Outer marginals rudimentary.

An interesting and unexpected addition to the fauna of Mt. Kinabalu. The species seems to be easily distinguished from other forms of *Meghimatium* by its shape and entire lack of any colour pattern. In all the other regional species of the genus the pattern is constant, though varying in intensity. It is found in young stages as well as in adult.

Meghimatium striatum (van Hasselt).

A single large specimen from Kamborangah, Kinabalu, 7,200 feet, April, 1929, F. N. C. and H. M. P.

About 45 mm. in length, it is marked with five longitudinal bands of purple brown on a yellowish ground.

The species, which ranges from Java to Formosa, China and Japan, has not hitherto been recorded from Borneo.

ARIOPHANTIDÆ

DYAKIINÆ

Everettia corrugata sp. n. Pl. XI, 1.

Type.—A specimen from Pakka, Kinabalu, 10,000 feet; April, 1929, F. N. C. and H. M. P.

Material.—Twelve specimens from Pakka, including the type.

Shell: thin, moderately globose, imperforate, dark brown. Diam. max. 17 mm. alt. 12 mm.

Suture impressed, whorls 5. Surface glossy, strongly corrugated immediately below the suture. Spiral striæ not visible. Ventral surface smooth. Last whorl increasing rather rapidly; aperture lunate, lip not thickened.

Body: ochre yellow in colour, with an ill-defined band of gray on each side of the tail, and on the dorsum of the front part of the body, whilst a paler, very ill-defined band of gray runs from the base of the tentacles to the mantle on either side.

The mantle is of the same colour as the body, but is densely spotted with jet-black, leopard-like markings. The surface of the visceral sac lying under the outer wall of the shell is similarly coloured, giving the translucent shell a speckled appearance when it contains the animal.

The genital apparatus is of the type characteristic of the genus.

The radula has the central tooth of the same size as the admedian on either side of it. Central and admedians tricuspid, laterals and marginals with minute entocone as in other species.

Formula 35–15–1–15–35.

The jaw has a definite median projection and is little curved.

The species is distinguished from other Bornean *Everettia's* by the globose shell, only *subimperforata* Smith surpassing it in this respect, and especially by the strong corrugations on the shell. These are much more marked than in *aglaia* Pfr. For comparison I figure the type of the latter, from the British Museum (Pl. XI, 2). When the genus is better known the body colour, with that of the mantle, as well as the radular formula, will no doubt prove useful specific characters.

In passing I may note that I believe all the species of this genus have a richly spotted mantle and visceral mass.

Everettia subconsul Smith. ?

Two specimens, Lumu-Lumu, Kinabalu, 5,500 feet, April, 1929, F. N. C. and H. M. P.

Both specimens are dead and immature shells. They resemble specimens collected by Everett on Kinabalu, and referred to this species by Smith. The larger specimen has Diam. Max. 14 mm. alt. 8 mm. Both are definitely shouldered at the periphery, and like other Kinabalu specimens seem to me to differ from the type of *subconsul* in the British Museum in this respect.

Kalamantania whiteheadi (Godwin-Austen).

One specimen Tenompok, 4,700 feet. F. N. C. and H. M. P.

The genus is known only from Kinabalu, but it is possible that Fulton's species *Helicarion rugosus* may be congeneric.

TROCHOMORPHINÆ

Eurybasis kina-baluensis (Smith).

Two specimens from Lumu-Lumu, 5,500 feet. Kinabalu. F. N. C. and H. M. P., April, 1929.

Immature and somewhat damaged.

PARMARIONINÆ

Microparmarion pollonerai Collinge and Godwin-Austen Fig. 3 b, 4.

First described from specimens from Pakka, 10,000 feet. coll. A. H. Everett. (Collinge & Godwin-Austen. Proc. Zool. Soc. London 1895, pp. 241–250, Pl. XI–XIV) 2 specimens from Marei Parei, 5,000 feet. F. N. C. and H. M. P.

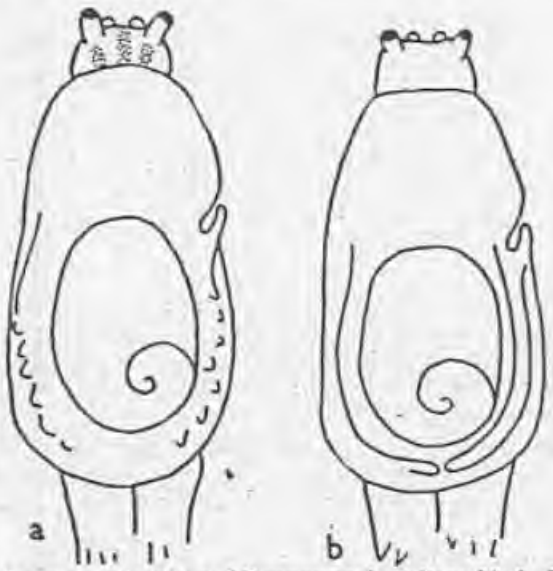

Fig. 3. Keels on mantle of: *a, Microparmarion simrothi; b, M. pollonerai.*

Body: dark bluish-gray, the lines of the coarse rugæ and the crest of the tail yellow. Foot entirely blue-gray.

Mantle paler than the rest of the body, yellowish-gray. That part of it which encircles the shell has, on the right side two parallel carinæ of which the upper starts from in front of the mantle opening, the lower from close behind it. Both run back and join each other in the middle line behind the shell. On the left there is a similar ridge, single in this case, this also runs back to behind the shell, turning down and disappearing as it reaches the middle line.

The account of the genital apparatus given by the authors of the species is brief, and the figures diagrammatic, but sufficient to show that the condition is identical with that found by myself on dissection.

The structure of the terminal part of the male duct is very peculiar, and it was only with the help of serial sections, kindly cut for me by Mr. Wadsworth of Manchester University, that I found it possible to understand the relations of the various parts of the organ.

From the point where the vas enters it this is essentially a single looped tube. It can be divided into a proximal part, lined by a cubical epithelium of a secretory nature, and a distal part whose lumen is lined by a pavement-like epithelium. The upper part may be called the epiphallus, the lower the penile.

Difficulty of interpretation of the relationship of the parts of the tube is due to looping of parts of it, with axial twisting.

The vas enters the upper part of the epiphallus on one side of it. This upper part is thick and the lumen of the vas breaks up as it enters, into a number of crypts, each lined with a deeply staining, rather cubical epithelium. These crypts branch in the thick walls of this part of the epiphallus, which are composed of connective tissue with some muscle fibres. The branching shows some evidence of being regularly arranged, but it is difficult to be sure of this owing to the plane of section.

At one part some of the crypts appear to be dilated, and approach the outer layer of the wall of the epiphallus, but for the most part they lie well within the core. In the dilated crypts the epithelium, though still with deeply staining nuclei, is rather flattened, as though stretched.

After a course of about 4 mm. the epiphallus bends abruptly on itself and at the same time narrows considerably, whilst the crypts merge into a single central channel with a single layer of rather columnar epithelium.

The epiphallus then again widens rather rapidly, and after a further course, in which it makes another sharp bend, it opens abruptly into the penile part.

At its first bend it is tied on to the penile part of the tube by a sheet of connective tissue and muscle fibres which pass out from the outer part of the sheath of the penile part, and pass in

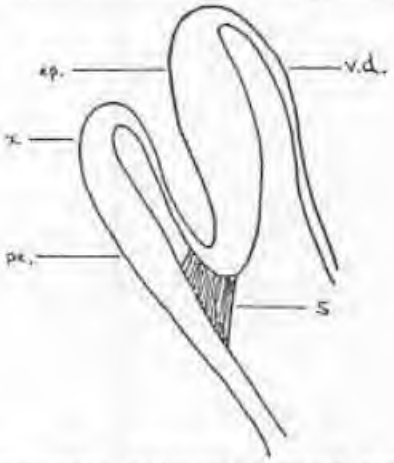

Fig. 4. *Microparmarion pollonerai*, terminal parts of male genital apparatus (diagrammatic, axial twisting not shown). *v.d.*=vas deferens; *ep.*=epiphallus; *x*=transition from epiphallus to penis; *pe.*=penis; *s*=sheath binding epiphallus to penis.

to fuse with the wall of the epiphallus. The retractor muscle of the penis rises from the same part of the penis.

At the level at which the epiphallus passes into the penis the change is marked by a short invagination of the lining of the tube, this possibly acts as a sphincter.

The lumen of the penile part is encroached on by rather regularly arranged processes which project into it, and are covered by a single layer of pavement epithelium with feebly staining nuclei.

These processes are figured by Godwin-Austen (loc. cit., Pl. XII, fig. 24).

The radula is similar to that of the next species and has the formula 60–25–1–25–60. (*See* Gowin-Austen's figure, loc. cit., fig. 19).

The adult animal measures about 40 mm.

Microparmarion simrothi Collinge and Godwin-Austen. Fig. 3 a.

First described from specimens from Pakka, 10,000 feet. coll. A. H. Everett.

Kenokok 3,300 feet.

Lumu-Lumu, 5,500 feet.

Kamborangah, 7,200 feet.

All dated April, 1929, F. N. C. and H. M. P.

All agree with the authors' description and figures.

The animal is of a yellow colour, mottled with dark brown. Mottling most evident on the mantle, and on the sides of the body, especially on the tail.

On the head are three black bands, one median, and one running back from the tentacles on either side to the mantle.

The mantle is finely papillate. Unlike that of *pollonerai* it has no definite keels. There are however a number of tubercles on the sides of the mantle where it passes round the shell, and these tubercles may reasonably be regarded as derived from keels which have broken up and become quite irregular. They are represented in the figure of the species given by Collinge and Godwin-Austen, but not definitely referred to in their account.

The genital structures are very similar to those of *pollonerai*. I have not had serial sections cut for this species, but from my dissection I do not doubt but that the arrangement is similar in the two species.

Godwin-Austen gives the formula for the radula as 90–16–1–16–90.

A large individual measures about 45 mm.

Microparmarion sp.

Four examples, Pakka, Kinabalu 10,000 feet,March, 1929. F. N. C. and H. M. P.

All immature, the largest individual has a length of about 16 mm. The body is of a uniform gray colour, tending to darken on the dorsum. The mantle is also dark gray, but is mottled with small, pale blotches irregularly placed.

The two keels of the mantle on the right side meet in the middle line posteriorly at an acute angle, whilst the single left keel runs into the upper right keel also at a very acute angle.

The shell is membranous, of about one and a half whorls, brown in colour with a whitish apex.

The reproductive system of the individual that I dissected, has the loop on the epiphallus characteristic of the genus, but is otherwise evidently immature. The dart-sac is large, about 8 mm. in length. Possibly young examples of *pollonerai*, but differ in having the mantle mottled, and in the arrangement of the keels of the mantle

INCERTÆ SEDIS

Ibycus sp. Fig. 5, 6.

One specimen, Lumu-Lumu 5,000 feet, Kinabalu. April, 1929. F. N. C. and H. M. P.

Total length about 25 mm. Body very slender, pale yellow on the sides and below, passing to leaden gray above. Mantle rather darker lead colour. Rugæ diamond shaped. Foot long and slender, tail long, compressed laterally, about 3.5 mm. in depth, caudal lobe not conspicuous. Mantle with right and left lobes prolonged back to meet behind the shell, much attenuated posteriorly. Right shell lobe relatively very large and wing like, left minute. Shell very thin, damaged, probably of about 2½ whorls, increasing rapidly, Diam. max. about 5 mm.

Genital apparatus. The penis is a straight, narrow tube, slightly distended apically, where it is joined on its side by the vas, which widens a little as it passes into it. The dart-sac is a cylindrical tube of about the same calibre as the penis, with a small rounded knob at its apex. The receptaculum is pyriform, with a short stalk.

The radula has the central tooth long narrow and unicuspid, and there are at least 290 laterals on either side of it. These are minutely bicuspid. The radula measures 3.3 mm., width 2.5 mm., Rows 113 + nascent.

It bears a close resemblance to that figured by Godwin-Austen for his *Leptodontarion perakensis* (Proc. Malac. Soc.,

1909, VIII, p. 366, fig. 1) and also to that of *Ibycus minutus* figured by the same writer in the volume of the Fauna of British India dealing with the Zonitidæ, (p. 220, fig. 76).

The present species seems quite distinct from any other. It is characterized by the long wing-like right shell lobe of the mantle (about 6 mm. in length), and by the diamond shaped rugæ, well marked on the tail, but becoming less definite on the anterior parts of the body.

Damayantia is an allied genus not recorded from Kinabalu but found on other mountains in Borneo. It resembles *Ibycus* in having the body slender, the tail long and compressed, and the radula with very numerous minute teeth, but differs in that the shell is entirely enclosed in the mantle which is without distinct shell lobes.

The genus *Ibycus* ranges from Assam to Celebes and New Guinea.

Damayantia is confined so far as at present known to Borneo and Malaya.

Fig. 5. *Ibycus* sp. Teeth from radula, × 400.

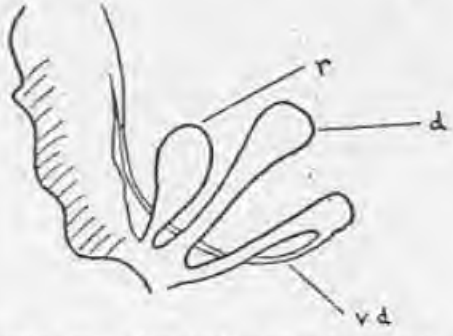

Fig. 6. *Ibycus* sp. Terminal part of genital apparatus. *r*= receptaculum; *d*=dart-sac; *v.d.*=vas deferens.

CYCLOPHORIDÆ

Cyclophorus kina-baluensis Smith.

This fine species seems to be found only on Kinabalu, but I can find no precise record of the altitude to which it attains. Adult specimens are very distinct from other species, but younger individuals show, I think, some relationship to *niahensis* Godwin-Austen. The latter is a lowland form, the Bornean representative of the Malayan *semisulcatus* Sowerby which again is closely related to the Sumatran *eximius* Mouss. and the Javanese *rafflesi* Brod. and Sow.

It is worth remark that in all these species, including *kina-baluensis* the same style of colour pattern is retained, just as in the various species and races allied to *perdix* there is strong resemblance in this respect whilst the sculpture and texture of the shell in some cases at least is very distinct.

Leptopoma undatum Metc.

A single specimen, taken by Dr. Hanitsch at a height of 4,200 feet, 23 March, 1899.

The specimen is dead and rather worn. Diam. max. 22 mm. alt. 19 mm. Moulton (Jour. Straits Br. R. A. S. Soc., 65, 1913, p. 7) records the species from a height of 4,500 feet on Mt. Poi, Sarawak, and also *L. sericatum* Pfr.

Undatum also occurs near sea-level. It shows considerable local and even individual variation, and is closely allied to *pyramis* Kob. from the Philippines. So far as I know it has no near relatives in Malaysia outside Borneo.

Leptopoma whiteheadi Smith.

One specimen, Kinabalu, 3,500 feet, March, 1899. R. Hanitsch.

The specimen is in bad condition, with broken apex, Diam. max. 13 mm., alt. 13 mm. Periphery rounded, last two whorls with strong, spiral liræ, of which I count ten on the last whorl. Traces of fine transverse lines between the liræ, but the shell is much worn. In general the shell bears a close resemblance to *lowi* but is rather larger than examples of that species in my possession, and the liræ are more strongly raised. It is probably an example of Smith's species, which itself is a form or local race of *lowi*.

Two specimens from "near Kadamaian River, Kinabalu 2,150 feet, March, 1899". Also collected by Dr. Hanitsch, and appear to belong to the same form, but have fewer liræ, 6 on one specimen 7 on the other. None of these specimens has retained the epidermis, so it is impossible to say whether it showed the "tufting" that Smith regarded as characteristic of the species.

Lagochilus alticola sp.n.

Type.—A specimen from Pakka, 10,000 feet, 23 March, 1929. H. M. P.

Material.—The type and two immature specimens from the type locality.

Shell rather depressed trochiform, of about 5 whorls, umbilicate, with the periphery strongly angled, but the angle becoming less marked towards the mouth. This is nearly circular, with a small but definite notch at the suture; lip not reflected, single. Colour greenish brown, with numerous darker brown, radial bands on the upper surface, lip black. The sculpture consists of very numerous, fine, spiral ridges, only evident on the upper surface under a lens, but more strongly marked on the under side. Diam. max. 9 mm. alt. 7 mm.

I am not anxious to add yet another name to the long list of Bornean forms that have already been described. But as this seems to be distinguished by its sculpture from any others, and as it is also recorded from a higher level than any Malaysian operculate has hitherto been known, I have decided that it is as well to describe it as new.

From *kina-baluensis* Smith it differs in having no definite liræ, and from *conicus* Smith in its more depressed form and wider umbilicus. Both the last named are recorded only for Kinabalu, where they were collected by Everett at a height of about 3,000–4,000 feet.

Mr. Pendlebury's specimens are dead and show no trace of epidermal hairs.

Cyclotus sp.

Three specimens (one quite immature), Marei Parei, Kinabalu 5,000 feet, April, 1929. F. N. C. and H. M. P.

The largest specimen has diam. max. 19.5 mm. alt. 8 mm. The spire is quite flat, umbilicus wide, whorls about 4, rounded and increasing rather rapidly, the last descending markedly from a short distance before the aperture. Mouth oblique, lip double, the outer fold small, lying at a right angle to the axis of the spire, pale violet in colour, with a small channelled expansion at the suture.

Colour rich, dark brown, with very numerous zig-zag yellow stripes, well marked above and below, but less evident at the periphery. Texture of shell rather silky, no hairs on the epidermis. Operculum, that characteristic of the genus.

The smaller mature specimen has diam. max. 17 mm. alt. 7.75 mm.

It has outer lip similar to that of the larger specimen but better developed. The zig-zag markings are wider, further apart and less numerous, especially on the under side.

I have found so much difficulty in making a satisfactory arrangement of the Bornean species of this genus that I prefer to leave these specimens without a name for the present.

They differ from *mindaiensis* (Bock) in having the periphery quite regularly rounded, and the mouth more descending, otherwise they look much like my example of that species. Another closely allied species *trusanensis* G.-A. has the whorls rather more inflated and the outer lip more expanded.

Dr. Hanitsch collected 4 dead specimens of a species of *Cyclotus* near the Kadamaian river, Kinabalu 2,150 feet in March, 1899. These are examples of the form that was described by Fulton as *amabilis*. These shells are rather larger than the form from Marei Parei, (diam. max. 23 mm. alt. 12 mm.) spire relatively higher, colour pale yellow, with irregular darker radial markings, and they are more solid and not so silky in texture.

Gastroptychia rubra (Godwin-Austen).

Four specimens. Lumu-Lumu 5,000 feet, Marei-Parei to Kamborangah 5,500–7,000 feet. F. N. C. and H. M. P. April, 1929.

These all agree fairly well with Godwin-Austen's description and figure. The type is from the Niah Hills.

Fulton's species *electa*, differing in colour, and with a relatively shorter spire seems closely allied. It is from British North Borneo.

The land Mollusca of Borneo are still very imperfectly known but it may be said that the fauna is the most definitely Malaysian of that found in any of the large land areas of Malaysia and that it is marked firstly by a high percentage of endemicity, probably at least 90% of the species being precinctive, and secondly by the rich development of a number of genera which are elsewhere in Malaysia represented by but few species. Such genera are *Everettia* and *Damayantia* among the Pulmonata, *Opisthostoma, Lagochilus, Gastroptychia* among the operculates. It is further true that the fauna is a very rich one and probably includes genera which do not occur elsewhere; whilst a certain number of groups characteristic of S. E. Asia, which occur in Malaya do not appear in the Bornean lists. A conspicuous example is the genus *Streptaxis*, whilst the true *Rhiostoma's*, rather richly represented in the Malay Peninsula, serve as an example among the operculates. The fauna of the mountain zone of Kinabalu is, I think, best described as an

epitome of the Bornean fauna as a whole. The only unexpected find is that of the new species of *Meghimatium*, all the others, including those found up to the tree-limit, are characteristic Bornean species. The ratio of Pulmonata to Operculata is approximately the same as that for the island as a whole; only at the highest level the Pulmonates are definitely in the majority, so far as our knowledge goes. It is probable that most of the species recorded from 7,000–10,000 feet are actually peculiar to Kinabalu.